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## ENGLISH RAILWAYS.

"FAMILIARITY," says the old proverb, "breeds contempt,"—and this is an aphorism which finds abundant verification in our own time. Wonders, which our fathers would have said were only the wild fancies of an overheated imagination, which we ourselves but a few years since thought impossibilities, have before our own eyes been so constantly and regularly achieved, and with their operations we have come into such habitual contact, that they often fail to excite within us the simplest homage of our admiration.

When coaches ran at six miles an hour including stoppages, it was thought that no ordinary triumph over space and time had been made; when the mail cleared ten miles within a similar period it was regarded by all thinking men as a prodigy; when it was said that twelve or even fourteen miles per hour might be attained on a railway, wise men shook their heads with incredulity at the possibility of so great a boon being within the reach of man; when express trains ran thirty miles in sixty minutes it was a miracle; and when the traveller may now be conveyed forty, fifty, and even sixty miles within a like period, and be whirled over some parts of the route at the rate of not less than even seventy or seventy-five miles an hour, the most thoughtful become indifferent to the full meaning of the work accomplished, and it is passed by because it is an every-day achievement. Even the lower orders of the animal world, which were at first filled with wonder and alarm, are now undisturbed in their pastures by the roar of the passing train—the cattle chew the cud close to the embankment without a quiver—the timid sheep fear it no more than the wind among the trees—and even the hen-partridge, running with her brood along the embankment of a deep cutting, will scarcely crouch as the iron monster rushes past. And just so the alarm which filled the minds of the multitude at such velocity of transit from place to place has been subdued, and almost the last remnant of astonishment or admiration seems to have been long ere this wrung from their being.

It here devolves upon us, however, to request the reader to give a few moments' attention to the wonders with which he has thus become familiar, and he will, perhaps, find that there are facts and incidents connected with this seemingly trite theme which may have escaped his attention and may be deserving of observation. Should this be the case, he will discover that his next journey by "the express" will have something more of meaning and of interest connected with it than it has hitherto possessed.

If the reader will pay a visit to the Euston-station in London at about nine o'clock, A.M., he will find that preparations are being made for the departure of one of the expresses on this railway. The train leaves at 9.15., and is destined for Birmingham, Crewe, Chester, Holyhead, Liverpool, and Edinburgh, and the passengers, attended by the porters and other officers of the company, are collecting at the station. The carriages which are to form the train are standing beside the curved platform, which seems to be indefinitely long, while the sun's warm rays gleam from above through the immense area of plate-glass which forms the roof, and light up the web of interlaced rods, bars, and bolts, by which the whole is supported. Porters bustle about with luggage of all kinds and shapes on their shoulders, or trundle little mountains of baggage to the vans in wicker-work trucks, which have been described as having the appearance of something between a clothes-basket and a badly constructed cradle.

The train is now rapidly filling, and the luggage is deposited in or upon the carriages. Stout gentlemen supply themselves with the daily newspapers from the "light-footed Mercuries" who vend them, the assistants of the agent at the book-stall. Other travellers, who are "used to this sort of thing," come in just as the first bell rings, and neither waste time by having to loiter on the platform till the train starts, nor get out of temper with themselves and all the world by being too late. Mild jokes are made available to keep up the spirits of friends about to part, about "sitting with one's back to the horses,"

or "a feed of coke" for the engine; and the good tempered hearers smile blandly as if they had never heard such wit before, though, according to accurate returns made by observers of human nature at railway-stations, it is probable that there are some scores expended before each train leaves the platform!

There are no second-class carriages to this train—a respect in which the London and North-Western Company is behind several of its contemporaries; but had it been otherwise, there is one sentiment which would be prevalent in the passengers' minds to their journey's end. It refers to the strong sensation which they experience of sitting on uncommonly hard seats. "Indeed, the theory has been fully discussed," says the author of "Our Iron Roads," "and is popularly regarded as in the highest degree plausible, that the directors of railways sent deputations of skilled carpenters all over the world to obtain the hardest wood which can be found, with which to make second-class seats. The result of their investigations have been most satisfactory to the companies; the only difficulty arising from a vague misgiving that perhaps the 'seconds' may flee to the third-class, which cannot be worse."

While witnessing the operation of loading a train at a principal terminus, the thought will scarcely fail to cross the mind of the observer, how various must be the feelings with which the embarkation is effected by the different passengers; how diverse the tones with which the words "good bye," are uttered by tongue and by heart. Sir Francis Head mentions an illustration in point, of the emotions which have been awakened at the moment of departure from this platform, to which we may refer. He was seated in the furthest corner of a carriage, when a clergyman from Brighton suddenly observed to his next neighbour in the same compartment, "There must surely be something very remarkable in that scene!" The incident to which reference was made was this. A young man of about twenty-two was standing opposite to a first-class carriage, just as the driver's whistle shrilly announced the immediate departure of the train. On this signal, without any affectation of any sort, he quietly reeled backwards on a baggage truck, which happened to be just behind him. Two elderly ladies who were with him instantly set to work, first of all most vigorously to rub with their fingers the palms of his hands, a process about as successful as if they had rubbed the soles of his boots; then they untied his neckcloth but their affectionate kindness was of no avail. The train was probably separating him from something, or from some one, and the emotions it excited were too much for his weak frame. What corresponding sensibilities may have been aroused within the bosom of any one in the train, we have no power to divine!

This incident may suffice to suggest how various may be the shades of feeling awakened within those who are taken and those left on the departure of a train. It has been well remarked, that "from the murderer flying from the terrors of justice, down to the poor broken-hearted debtor absconding from his misfortunes; from our careworn Prime Minister, down to the most indolent member of either House of Parliament, each simultaneously escaping after a long protracted session; from people of all classes going from or to laborious occupation, down to the school-boy reluctantly returning to, or joyfully leaving, his school; from our Governor-General proceeding to embark for India, down to the poor emigrant about to sail from the same port to Australia, in various classes and conditions of men—the railway-whistle, however unheeded by the multitude, must oftentimes have excited a variety of feelings, which it would be utterly impossible to describe."

At last the arrangements are completed, the signals of "all right" are exchanged between the guards, the manager, and the driver, the whistle sounds shrilly on the ear, the last adieus are uttered, and the whole fabric is in motion, and rapidly increasing its speed, it vanishes out of sight between the high walls of the cutting.

Well, the express is at length at full speed, and this opportunity may be rendered available for giving some idea of what is involved in order to attain the enormous speed of locomotion which is reached.

Suppose a train to move at seventy miles an hour—a speed not unfrequent in the expresses on the Great Western Railway—this is, in round numbers, 105 feet per second; that is to say, the passenger is carried over thirty-five yards in the space of time between two ticks of a common clock. If two trains pass one another at such a speed the relative velocity is double that, or seventy yards per second; and if one of the trains were seventy yards long, it would flash by in a single second.

If the movements of the machinery thus brought into action be tested, it will be found that some curious facts are brought to light. In making this inquiry, Dr. Lardner—of whose valuable researches on this point we here avail ourselves—begins with the supposition that the driving wheels of the engine are about seven feet in diameter, and, consequently, that they measure a little more than twenty-one feet, or seven yards, in circumference. These wheels would revolve five times in running over thirty-five yards of the rails; and as this space is, on the supposition made, passed over in one second, these driving wheels must at such a speed revolve five times a second. Now, to produce one revolution of the driving wheels, each piston must once move backwards and forwards in the cylinder, and its motion, therefore, must divide a second into ten equal parts. On arriving at the end of the cylinder a valve must be shifted so as to admit fresh steam on one side of the piston, and that it may be withdrawn on the other; and this valve must move so rapidly as to form but a small fraction of the entire stroke of the piston.

But there are two cylinders, and the mechanism is so regulated that the discharge from the one is intermediate between two successive discharges from the other. There are, therefore, twenty discharges of steam per second, at equal intervals; and thus these twenty puffs divide a second into twenty equal parts, each puff being the twentieth of a second between it and that which precedes and follows it. It is these blasts of steam which produce that coughing noise heard when a locomotive engine is moving slowly.

Now, according to the experiments of Dr. Hutton, it appears that the flight of a cannon ball is at about five miles a minute, or three hundred miles an hour; in other words, that a train moving at seventy-five miles an hour has a velocity only four times less than that of a cannon ball. The heavy cannons employed in the broadside of a line-of-battle ship are almost all thirty-two pounders, and we may form some idea of the destruction which these masses of iron occasion when they are thrown with all their tremendous momentum against any object. But when we remember that a railway train weighs, not thirty-two pounds, but, perhaps, seventy-five tons, and that the speed of a train at seventy-five miles an hour is but a fourth less than that of a cannon ball, we have this surprising conclusion presented to us, that, when we take our seat amidst the soft cushions of such a train, we are embarking in an agent which will soon have a momentum equal to that of a cannon ball flying through the air, of some eighteen tons weight! To sit astride of a bomb-shell—setting apart the danger of explosion, and the inconvenience of exposure to the air—is nothing, in contrast with the tremendous power with which we are associated in our journeyings over the land in such a vehicle as an express train on the Great Western Railway.

Of the total number of engines employed upon the English lines an estimate may be formed from the fact, that to stock a line requires an average of half an engine a mile; while there were opened for traffic throughout the country on the 1st of December, 1851, 6,890 miles of railway. The actual number of engines on the 863 miles worked by the London and North-Western Railway, is 582; on the South-Western, on 244 miles, 118 engines.\*

And here a few words about the carriages may not be out of place. Of the numbers of these in existence some idea may be gained from the fact, that the carrying stock of the railways of the kingdom includes no fewer than some sixty thousand vehicles, about one-tenth of which are for passengers. The value of the whole stock is estimated at £4,000,000 sterling.

The cost of constructing a first-class carriage, affording accommodation for eighteen passengers, is about £380; a second-class, to hold twenty-five, £260; and horse-boxes may be built for about £150. Formerly the prices were much higher, but with the increase of experience in their erection they have been greatly improved, and the cost greatly diminished. The stock of carriages in the coaching department of the London and North-Western Railway was, on the 31st of December, 1851, as follows:—

The carriage stock of railway companies is generally of such design and construction, and kept in such a state of efficient repair, that accidents arising from their failure are very rare. The wheels and axle-boxes are the most severely tested parts of the vehicles, but if originally well made they give little trouble in their maintenance and repair. A spring sometimes breaks, and a tire occasionally fails—in which case the wheel is in danger of being thrown into pieces by the centrifugal velocity—but the instances are so rare, that they are not a source of much anxiety. Many kinds of wooden wheels have been constructed, and these are considered to possess some decided advantages over those made of iron. Special care has to be exercised in reference to all those parts of the vehicles which have been supplied by contract, and hence some companies invariably furnish certain parts of the machinery themselves, in order to avoid the possibility of defective workmanship. Where the original construction is what it ought to be, the carriages, if daily examined, may be relied on for a very long period. Thus Captain Huish informs us, that during the last four years only six wheels have failed in the very large stock of the London and North-Western Railway Company.

The heating of axles has in several instances occasioned no small annoyance and alarm to passengers, who have suddenly discovered the fact that the carriage in which they are travelling, and to which they are confined, is on fire, while the rapid motion of the train serves at once to promote combustion and to prevent escape. Some modifications which have been made in the shape of the wheels, and more attention to their management, has greatly diminished this cause of danger; while the recent introduction of the patent axlè-box, which with proper care will run many hundred of miles without being fed, gives promise that the evil will be abated to a considerable extent, if not prevented altogether. Still, on a hot summer day, in a district where sandy ballast prevails, it is, and always will be, very difficult to keep the axles of a fast train cool.

The power of many of the engines is very great. On the broad-gauge the "Lord of the Isles," which was shown at the Great Exhibition, may be regarded as a type of a class of singularly powerful construction. It is capable of taking a passenger train of some hundred and twenty tons at an average speed of sixty miles an hour, its effective power equalling 743 horses. On the narrow-gauge there are engines of equal capacity in point of strength, but not, we opine, in speed. We understand, however, that special efforts are being made by the London and North-Western line to increase the speed of their expresses, more particularly between London and Birmingham, to which a line is now opened from the metro-

• "Our Iron Roads: their History, Construction, and Social Influences."

polis *via* Oxford on the broad-gauge. To put themselves in a better position for combatting with their powerful rival for the traffic on this route, they are making great efforts, by the formation of new engines, to which we shall have again to advert.

The appearance presented by the engine-driver, whose hand guides and controls the mighty energies of the steam-horse, as he thus seems to "ride upon the storm" of conflicting forces, is full of interest and almost of terror. When it is remembered that he has not merely to regulate the working of an elaborate and costly apparatus, and to make its operation as greatly powerful and as little expensive as possible, but to act with decision under exigencies which may arise at any moment, and to discover expedients amidst unexpected difficulties, his attention being roused by the consciousness that not only is valuable property and the lives of many passengers entrusted to his skill and care, but that should any inadvertency arise, his own life will be the first to be sacrificed;—while the train advances, whether mounting the earthy heights of an embankment, rushing over the seemingly frail fabric of a wooden

between the Great Western and the London and North-Western Companies. The relative speed of the fastest trains between London and Bristol, and London and Birmingham, are as follows:—

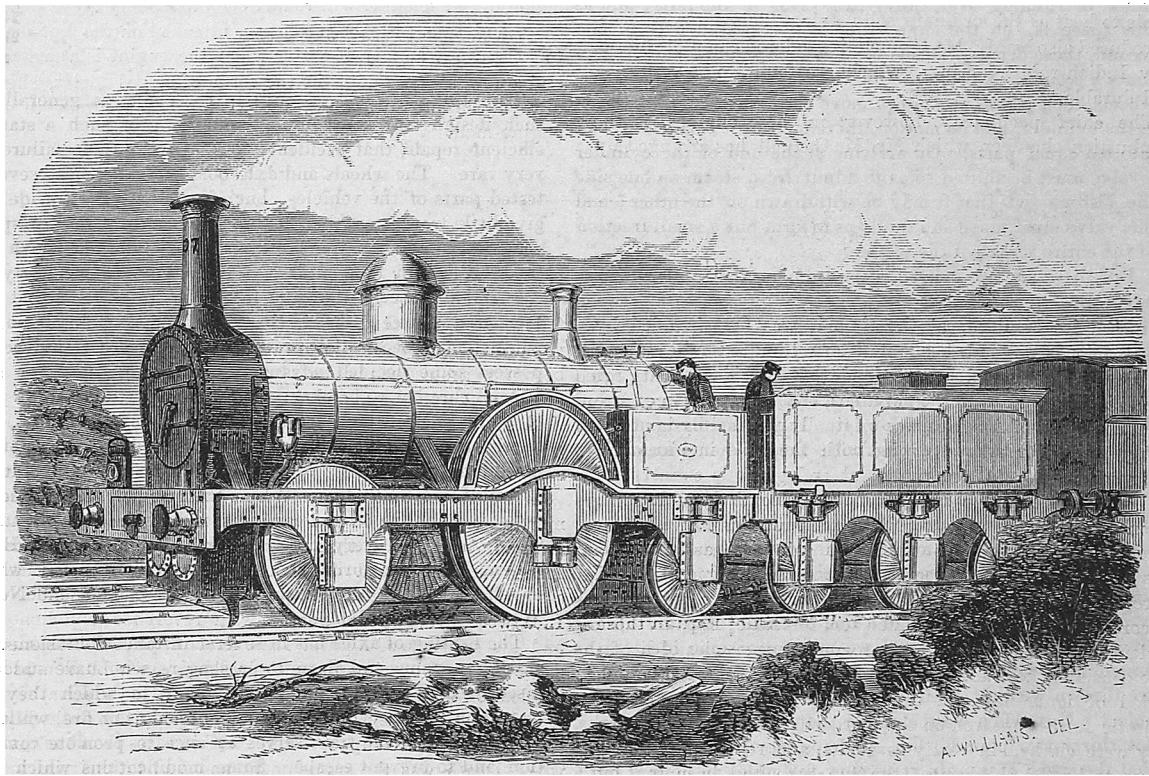
Great Western Railway .. .. .. ..	43 miles per hour.
North-Western .. .. .. ..	40 "
Difference in favour of the Great Western ..	3 "

The speed of all the mixed trains between London and Plymouth, and London and Liverpool, is—

North-Western .. .. .. ..	36½ miles per hour.
Great Western .. .. .. ..	35½ "
In favour of the North-Western .. .. .. ..	1

The average fares are:—

Great Western .. .. .. ..	1st class, 3·06d per mile.
	2nd class, 2·50d.
North-Western .. .. .. ..	1st class, 2·67d.
	2nd class, 2·17d.



MAC CONNELL'S PATENT EXPRESS ENGINE.

bridge, or within the dark bosom of the mountain side, he must be keenly alive to all the duties of his post.

From personal observation we can aver that this is not an easy task, even on a fine day in summer, and at a moderate speed. But when the journey is performed amid the intense and blinding darkness of a wintry night,—when the cold blast of the north wind sweeps triumphantly over the land in one direction, and the engine-driver is dashing through it in the opposite, at forty, fifty, or sixty miles an hour, backed by a train of carriages weighing, perhaps, a hundred tons or more,—and when, with straining eye-ball he has to look ahead to see that no blood-red signal is announcing to him that he must stay his onward course at once, under peril of instant and inevitable destruction,—it is under circumstances like these that we see the energy, the care, and the coolness required to fulfil aright the heavy responsibilities entrusted to the engine-men.

In alluding to the speed attained, and the fares exacted, by the different railways, a comparison will be best instituted

A comparison of the time occupied, and the fares charged on a journey of 246½ miles on both lines shows that there is a difference in time in favour of the North-Western of—

34 minutes by a first-class train.
12 " " second do.
8s. 1d. by a first-class.
6s. 8d. " second do.

By the ordinary trains the average speed per hour is—

North-Western .. .. .. ..	26½ miles.
Great Western .. .. .. ..	25 "
In favour of the North-Western .. .. .. ..	1½ "

It is, however, worthy of remark, that on the Great Western Railway there are second-class carriages to the express trains, while on the North-Western this is not the case.

The first pair of the new magnificent express engines for the London and North-Western Railway to run to Birmingham in two hours, which were designed by and made to the instructions of Mr. Mc Connell, the locomotive superintendent of that company, have been delivered, one from the manufactory of Messrs. Fairbairn of Manchester, and the other from Messrs. E. B. Wilson and Co., of Leeds. These engines have attracted much attention from the excellence and novelty of the design, as well as from the beauty and finish of their workmanship. No pains have been spared by the makers to do full justice to the plans.

The driving wheels of these engines are seven feet six inches in diameter, the strokes is twenty-four inches. The tubes are 303 in number, and 1 $\frac{1}{2}$  inches in diameter, and the fire-box contains 260 square feet of heating surface. These engines are fitted up with Mr. Mc Connell's patent solid wrought iron piston, which, in addition to superior strength and durability, is one-third lighter than those hitherto used; so that at a speed of sixty miles per hour a momentum will be saved on the two pistons equal to 80 tons. They have also tubular axles under both engine and tender, which, by saving dead weight, and at the same time giving a stronger form, are also not so liable to heat as the ordinary solid axle. This improvement, introduced also by Mr. Mc Connell, is rendered complete by the new Indian-rubber springs, which are found to be very easy and durable.

The chief peculiarity, however, in these engines, is the combustion chamber, which Mr. Mc Connell has arranged by

introducing the fire-box, or direct heating surface, into the cylindrical part of the boiler, to the extent of four feet nine inches. This is a most important step, and will tend to great economy: the result of nine months' trial of an ordinary engine so altered shows a saving of nearly 30 per cent. of fuel used for the work done, and as fuel forms more than half the expenditure the economy must be very great. As an evidence of the superiority of the method thus employed, it may be mentioned as a remarkable fact, that within forty-five minutes of the time that the furnace is first lighted, a pressure of steam equal to a hundred pounds on the square inch may be indicated. The estimated power of the new engine when running at a high velocity is not less than 650 horses, and it is confidently hoped that long-sustained speeds of seventy miles an hour will be obtained. This arrangement Mr. Mc Connell has further improved, by "recessing" the under part of the boiler for the crank shaft, which lowers the centre of gravity upwards of ten inches.

It is confidently expected, that a speed of at least seventy miles per hour may be sustained throughout their working with great ease, while the steadiness and beautiful action of the machine will render such a velocity quite steady, easy, and safe. Steam pumps are attached on the foot-plate, to keep up a supply of water when the engine is at a stand, and a new steam gauge in the form of a gas meter, shows always the pressure of steam with great accuracy to the engine-man.

### A GOSSIP ABOUT PERU.

THE Empire of Peru, at the time it was first invaded by the Spaniards, extended about fifteen hundred miles along the Pacific Ocean, and had attained to a considerable degree of civilisation. Tradition informs us, that this portion of the great continent of America was originally peopled by ignorant savages, who for ages struggled with the evils incidental to their condition. As yet the great and glorious country, of which Peru was but a small district, was entirely unknown. Upon other stages the world's drama was enacting, upon other arenas the world's struggle was going on, and here all was darkness and ignorance—the elements of a moral world were awaiting the eternal fiat to evolve into a new system. According to the accounts which still remain of Peru in those ancient times, and by reference to a strange species of literature consisting of knotted cords—it appears that after a long period of ignorance and barbarism, a man and woman of majestic form appeared on the borders of the Lake Titicaca; they were clothed in costly garments, and represented themselves to be the children of the Sun, who had been sent by their beneficent parent to instruct and reclaim the inhabitants of the earth.

Assisted by some of the neighbouring tribes, Manco Capac, and Mama Oollo, for such were the names of these strangers, founded the city of Cusco, and there commenced the first Peruvian government, its extent being bounded by a few provinces. From these children of the sun the Peruvians were instructed in those arts which civilise and advance mankind, and while Manco Capac showed the untaught people that the earth could be tilled and made to yield her increase by the art of man, Mama Oollo taught the women to spin and weave.

From our stand-point of civilisation these old legends seem strange and unaccountable, for in these founders of their empire the people of that district recognised a divine emanation—to them they were messengers from heaven, not only mortal in their nature, but a mysterious incarnation of deity. So it is all history begins. In the gray light of the morning familiar objects assume unwonted aspects, and grow gigantic in the duskiness; and so it is with history, its early dawn is lost in dim obscurity, and men but slightly raised above their

fellows appear as God-like in the partial light. China loses its wondrous history in dim mysterious shadows; Hindooism becomes grotesque; Jotuns and thunder gods begin all northern chronicles; and in common with them all Peru deifies its earliest benefactors, and not only admires but adores those who were the first to teach the lessons of civilisation and advancement.

The children of this mysterious pair, so says the legend, married each other in order to preserve their divine nature from admixture with that of men, and twelve generations in succession now ruled over the empire. Their government assumed the character of a theocracy. The messengers of the Inca were everywhere treated with reverence and honour, and his subjects of highest rank never appeared in his presence without bearing upon their shoulders a burden as an emblem of their servitude. The laws which the Inca established must be obeyed. They had not only the authority of the ruler, but were supposed to be nothing less than the divine will. Death was the punishment annexed to their infringement in the smallest degree. But beneath the sway of the Inca, despotic as that sway became, we hear of but little oppression. It was rather a patriarchal than kingly system. Under its genial influence they were more humane than many European nations.

"In Peru, agriculture was carried on with more skill and to a greater extent than in Mexico, and there was accordingly a greater abundance of food. The people were acquainted with both the arts of manuring and of irrigation. In turning up the soil for seed, which was done by a kind of wooden mattock, both sexes were employed. Their houses, especially those in the higher and colder regions, were superior to the hovels of Mexico, and their temples and other public edifices were extensive, and of massive and elegant form. Two roads, which extended through the length of the country, were equally wonderful monuments of the power of the Incas, by whose orders they were constructed. The one was conducted through the interior and mountainous country, the other through the plains on the coast. 'We were surprised,' says Baron Humboldt, 'to find in this place, and at heights which greatly surpass the top of the peak of Teneriffe, the magnificent remains of a road